# Chapter 12 Stoichiometry: Practice Test

*Solve the following problems in the space provided. Show your work.*

1) How many grams of CO are needed to react with an excess of $Fe_2O_3$ to produce 558 g of Fe? The unbalanced equation for the equation is:

$$Fe_2O_3(s) + 3CO(g) \rightarrow 3CO_2(g) + 2Fe(s)$$
(3 = B, 2 = A)

$$558\,g\,Fe\left(\frac{1\,mol\,A}{55.85\,g}\right)\left(\frac{3\,mol\,B}{2\,mol\,A}\right)\left(\frac{28\,g}{1\,mol\,B}\right) = 420.\,g\,CO$$

2) a. What is the limiting reagent when 50.2 g of nitrogen react with 10.7 g of hydrogen according to this balanced equation?
b. What mass of ammonia would be produced?

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$
(A, B) $H_2$ is limiting

$50.2\,g\left(\frac{1\,mol}{28\,g}\right) = 1.79$ $\quad 10.7\,g\left(\frac{1\,mol}{2.0\,g}\right) = 5.2$

$1.79 = 1\,mol\,N_2$ $\quad 5.2 = 2.9\,mol\,H_2$

$H_2$ is limiting

$$10.7\,g\,H_2\left(\frac{1\,mol\,A}{2.0\,g}\right)\left(\frac{2\,mol\,B}{3\,mol\,A}\right)\left(\frac{17\,g}{1\,mol\,B}\right) = 60.6\,g\,NH_3$$

3) a. If 4.0 g of $H_2$ are made to react with excess CO, how many grams of $CH_3OH$ can theoretically be produced according to the following equation?

$$CO(g) + 2H_2(g) \rightarrow CH_3OH(l)$$
(A, B)

$$4.0\,g\,H_2\left(\frac{1\,mol\,A}{2\,g\,A}\right)\left(\frac{1\,mol\,B}{2\,mol\,A}\right)\left(\frac{32\,g}{1\,mol\,B}\right) = 32\,g\,CH_3OH$$

b. If 28.0 g of $CH_3OH$ are actually produced, what is the percent yield?

$$\frac{28.0\,g}{32.0\,g} \times 100 = 88.5\,\%$$

5) A $5.00 \times 10^2$ g sample of aluminum sulfate is made to react with 450 g of Calcium hydroxide. A total of 596 g of calcium sulfate is produced.

a. Write the balanced chemical equation for the reaction.

$$\underset{A_1}{Al_2(SO_4)_3} + 3\underset{A_2}{Ca(OH)_2} \rightarrow 3\underset{B}{CaSO_4} + 2Al(OH)_3$$

b. What ~~is the limiting~~ reagent in this reaction?

$Al_2(SO_4)_3$ is limiting

$$5.00\times10^2 g\ A_1\left(\frac{1mol}{342g}\right)\left(\frac{3mol\ B}{1mol\ A}\right)\left(\frac{136.15}{1mol\ B}\right) = 597g$$

$$450g\ A_2\left(\frac{1mol}{74.1g}\right)\left(\frac{3mol\ B}{3mol\ A_2}\right)\left(\frac{136.15}{1mol}\right) = 826.8g$$

b. How many grams of excess reagent are unreacted?

$$5.00\times10^2 g\left(\frac{1mol}{342g}\right)\left(\frac{3mol\ A_2}{1mol\ A}\right)\left(\frac{74.1}{1mol\ A_2}\right) = 325g\ Ca(OH)_2$$

$450 - 325 = 125$ g excess

c. What is the percent yield of $CaSO_4$?

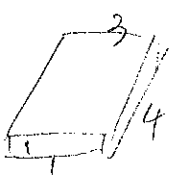
$$\frac{596}{597}\times100 = 99.8\%$$

7) The decomposition of potassium chlorate gives oxygen gas according to the reaction:

$$\underset{B}{2KClO_{3(s)}} \rightarrow 2KCl_{(s)} + \underset{A}{3O_{2(g)}}$$

How many grams $KClO_3$ are needed to produce 7.14 g of $O_2$?

$$7.14g\ O_2\left(\frac{1mol\ A}{32g}\right)\left(\frac{2mol\ B}{3mol\ A}\right)\left(\frac{122.6}{1mol\ B}\right) = 18.2g\ KClO_3$$



8) Suppose that the reaction described in question 7 produces 6.86 g of $O_2$ in the laboratory. What is the percent yield?

$\frac{6.86}{7.14} \times 100 = 96\%$

A

Answers:

1) [$H_2$ is limiting]
   [ 60.3 g $NH_3$]
2) [420. g CO]
3) [4.94 g $C_4H_{10}$]
4) [32.0 g $CH_3OH$]
   [ 87.5 %]
5) [$Al_2(SO_4)_3$]
   [125g excess $Ca(OH)_2$]
6) [21.4 g $O_2$]
7) [18.2 g $ClO_3$]
8] [96% yield]

$Al^{3+}$ $SO_4^{2-}$